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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/733,201

12/09/2003

Garo J. Derderian

MI22-2402

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7590

05/14/2007

WELLS ST. JOHN P.S.

601 W. FIRST AVENUE, SUITE 1300

SPOKANE, WA 99201

EXAMINER

STOUFFER, KELLY M

ART UNIT

PAPER NUMBER

1762

MAIL DATE

DELIVERY MODE

05/14/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/733,201

Applicant(s)

DERDERIAN ET AL.

Examiner

Kelly Stouffer

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 November 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-82 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 9-12, 35, 37, 38 and 52-55 is/are allowed.
- 6) ☒ Claim(s) 1-34, 36, 39-51 and 56-82 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application
- ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, filed 30 November 2006, with respect to the specification/drawings and claim 26 have been fully considered and are persuasive.

The objections of the specification/drawings and claim 26 have been withdrawn.

Applicant's arguments, filed 30 November 2006, with respect to the 35 USC 112 rejection of claim 8 have been fully considered and are persuasive. The 35 USC 112 rejection of claim 8 has been withdrawn.

Regarding the 35 USC 102(b) rejection under Werkhoven et al. (hereafter Werkhoven) the applicant argues that Werkhoven does not show the creation of a porous oxide and that it cannot be shown to be inherent from Werkhoven. However, Werkhoven uses the same procedure in claim 1 as the applicant in making the oxide. In the applicants' own specification, the applicant attributes porosity of the oxide to use of remote nitrogen plasma (paragraph 0030 of the instant specification). This section of the instant specification suggests that this is an inherent property, as long as remote plasma nitrogen is used on the film. Therefore, since Werkhoven uses this as well, it is inherent that the oxide produced by their procedure is porous. Therefore, the majority of the 35 USC 102(b) rejection under Werkhoven is maintained and repeated here. Due to amendments, other rejections are withdrawn, as discussed below.

However, the examiner omitted the rejections of claims 48-51 and 56 in the previous office action. Since they are now rejected below, the finality of this office

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action is withdrawn due to new grounds of rejection not necessitated by amendment and the present office action is non-final.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 80-82 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 80-82 recite the limitation of forming the porous oxide or aluminum oxide void of nitrogen. The specification does not provide support for forming an oxide layer. The mere absence of such a recitation in the specification is not a basis for support for a negative claim limitation. In addition, in paragraph 0043 of the instant specification, the applicant nitride reacts with oxide to **substantially** remove nitrogen from being formed in the oxide layer, which indicates that some nitrogen may remain in the layer and hence it is not **void** of the nitrogen as now claimed.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3 Claims 1-5, 14-17, 27-34, 36, and 39 are rejected under 35 U.S.C. 102(b) as being anticipated by US Publication number 2001/0041250 A1 to Werkhoven et al.

Claim 1 of the applicant requires a porous oxide deposited by atomic layer deposition (ALD) on a substrate in a chamber with repeated steps of a first adsorbed monolayer and second step of contact with oxygen and nitrogen remote plasma. Werkhoven et al. discloses a process for forming a porous oxide (Werkhoven uses the same procedure in claim 1 as the applicant in making the oxide. In the applicants' own specification, the applicant attributes porosity of the oxide to use of remote nitrogen plasma in paragraph 0030 of the instant specification. This section of the instant specification suggests that this is an inherent property, as long as remote plasma nitrogen is used on the film.

Therefore, since Werkhoven uses this as well, it is inherent that the oxide produced by their procedure is porous) on a substrate in a chamber by ALD (paragraphs 0034 and 0042 lines 3-6 and 1-3 respectively) consisting of the steps of depositing a monolayer of the oxide in paragraph 0055 lines 1-5 and then contacting it with oxygen and nitrogen remote plasma (paragraph 0060 lines 1-5) where the oxygen plasma source contains ozone (paragraphs 0046 lines 6-7 and paragraph 0048 et seq.) Werkhoven et al. meets all the recitations of claim 1, at least as broadly recited by claim 1.

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In claims 2 and 3 the applicant requires an electrically insulative oxide, and an oxide comprising SiO_2 . Werkhoven et al. discloses the film as SiO_2 in paragraph 0085 lines 1-2, which by nature may be electrically insulative. Werkhoven et al. meets all the recitations of claims 2 and 3, at least as broadly recited by claims 2 and 3.

In claims 4 and 14 the applicant requires an oxide comprising Al_2O_3 with a trimethyl aluminum precursor and aluminum component in the film. Werkhoven et al. discloses the film as Al_2O_3 with a trimethyl aluminum precursor and aluminum component in the film in paragraphs 0088 and 0089 et seq. Werkhoven et al. meets all the recitations of claims 4 and 14, at least as broadly recited by claims 4 and 14.

With regard to claims 15 and 17, the gaseous precursor for silicon dioxide includes a silane in paragraph 0046 lines 1-6. . Werkhoven et al. meets all the recitations of claims 15 and 17, at least as broadly recited by claims 15 and 17.

With regard to claim 16, Werkhoven et al. discloses a silicon source gas that can be any gas containing silicon in paragraph 0046 lines 1-6. This includes TEOS as required by the applicant. Werkhoven et al. meets all the recitations of claim 16, at least as broadly recited by claim 16.

With regard to claims 27-29, Werkhoven et al. discloses the oxygen source gas as O_2 or O_3 in paragraph 0046 lines 6-7 and paragraph 0048 et seq. Werkhoven et al. meets all the recitations of claims 27-29, at least as broadly recited by claims 27-29.

With regard to claims 30-34, 36, and 39, Werkhoven et al. discloses the nitrogen source and oxygen source processed into a plasma by a plasma generator 60 in Figure 1 as described in paragraph 0060 lines 1-5. The nitrogen source can be separate from

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the oxygen source and fed into the chamber at different times spaced from one another or included in the oxygen source as a mixture from the same plasma generator 60.

The two sources can also be entered into the chamber at times that overlap one another as disclosed in paragraph 0072 lines 1-4. Werkhoven et al. meets all the recitations of claims 30-34, 36, and 39, at least as broadly recited by claims 30-34, 36, and 30.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
4. Claims 40-48, 57-58, and 65-73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Werkhoven et al. Werkhoven et al. is described in section 3 above and includes all recitation of claims 40-48, 57-58, and 65-73 at least as broadly recited

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by the applicant with the exception of including specific percentage by volume concentrations of nitrogen in the remote plasma. Werkhoven et al. teaches that the reaction between the silicon layer and the nitrogen source (in this case ammonia) has a different thermodynamic capability than the reaction between the silicon layer and the oxygen source (paragraph 0070 et seq.). The appropriate concentration of nitrogen is said by Werkhoven et al. to be by routine experimentation to account for the thermodynamic competition between the nitrogen and oxygen reactions in paragraph 0070 et seq. The variable of nitrogen concentration in the plasma depends upon the reaction conditions, and its importance is in accounting for the thermodynamic competition therefore it is a result-effective variable and its modification is not inventive.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify Werkhoven et al. by routine experimentation to include nitrogen concentrations in the nitrogen and oxygen remote plasma in the ranges of 0.01-90%, 0.1-10%, 0.1-3%, 0.01-1% by volume in order to account for the thermodynamic competition between the oxygen and nitrogen reactions with the surface layer absent evidence showing a criticality for the abovementioned ranges. (See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955))

5. Claims 5-8, 13, 18-20, 48-51 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Werkhoven et al. in view of US Patent number 4652463 to Peters. Werkhoven et al. is described above and includes a method for making an insulative oxide film (aluminum oxide) with a vapor precursor of trimethyl aluminum.

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Werkhoven et al. in paragraph 0017 et seq. also describes the desirability of a layer comprising a conductive material to reduce electromigration. Werkhoven et al. does not include using a conductive layer such as indium oxide, tin oxide, or indium-tin oxide (a film that contains multiple cations) with precursors of trimethyl tin or trimethyl indium. Peters teaches a method for making a conductive oxide film that consists of indium oxide, tin oxide, or indium-tin oxide with precursors of trimethyl tin or trimethyl indium (column 7 lines 40-46) because indium oxide, tin oxide, and indium-tin oxide have properties of high transparency, mechanical hardness, and environmental stability (column 1 lines 40-44).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Werkhoven et al. to include film of indium oxide, tin oxide, or indium-tin oxide with precursors of trimethyl tin or trimethyl indium as taught by Peters in order to produce a film that has properties of high transparency, mechanical hardness, and environmental stability.

6. Claims 21-26, 59-64, and 74-79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Werkhoven et al. in view of US Patent number 6960537 to Shero et al. Werkhoven et al. is described above and includes an ALD method for producing an oxide film that includes the use of nitrogen remote plasma. Werkhoven et al. does not include the nitrogen source of the remote plasma to be N_2 , N_2O , or NO . Shero et al. teaches the source gas of the nitrogen remote plasma to be N_2 , N_2O , or NO in order to

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provide a plurality of nitrogen sources to the inlet 54 in Figure 1 as disclosed in column 8 lines 5-20.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify Werkhoven et al. to include the nitrogen source of the remote plasma to be N_2 , N_2O , or NO as taught by Shero et al. in order to provide a plurality of nitrogen sources to the plasma generator and reaction chamber.

Allowable Subject Matter

7. Claims 9-12, 35, 37-38 and 52-55 are allowed for reasons discussed in the previous office action, as they contain allowable limitations re-written in independent form.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kelly Stouffer whose telephone number is (571) 272-2668. The examiner can normally be reached on Monday - Thursday 7:00-5:30.

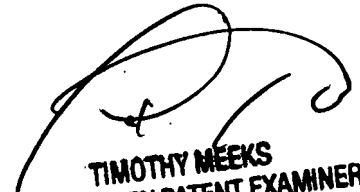
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Kelly Stouffer
Examiner
Art Unit 1762

kms



TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER